

Inventor Kiaran McGee, et al.
Serial No.: 10/016,527
AMENDMENT
Page 2

Client Docket MMV-01-042

Amendments to the Claims

1. (Currently Amended) A method for producing an image of a subject with a magnetic resonance imaging (MRI) system which enables a previously implanted device to be located, the steps comprising
 - a) acquiring a first k-space data set with the MRI system using a first pulse sequence suitable for imaging stationary spins;
 - b) acquiring a second k-space data set with the MRI system using a second pulse sequence suitable for imaging stationary spins which is different from the first pulse sequence;
 - c) reconstructing first and second complex MR images of the subject from the respective first and second k-space data sets;
 - ~~d)~~e) calculating a magnitude MR image from either one of said first or second complex MR images reconstructed in step c); and
 - ~~e)~~d) calculating a phase difference MR image ~~from~~ between the first and second complex MR images of step c);
 - f) employing the phase difference MR image of step e) to locate the implant in the subject; and
 - g) displaying the location of the implant from step f) in the magnitude MR image from step d).
2. (Original) The method as recited in claim 1 in which said first pulse sequence is a spin-echo pulse sequence in which an NMR echo signal is produced after an RF refocusing pulse is produced, and the second pulse sequence is a gradient-recalled echo pulse sequence in which an NMR echo signal is produced after an RF excitation pulse is produced.

Inventor Kiaran McGee, et al.
Serial No.: 10/016,527
AMENDMENT
Page 3

Client Docket MMV-01-042

3. (Original) The method as recited in claim 1 in which step c) is performed by performing a complex Fourier transformation of each of the first and second k-space data sets.

4. (Currently Amended) The method as recited in claim 1 in which step e) d) is performed by:

- i) calculating a first phase image from the first complex image;
- ii) calculating a second phase image from the second complex image;
- iii) calculating the phase difference image by computing the phase difference between corresponding pixels in the first and second phase images.

5. (Canceled) The method as recited in claim 1 in which step f) is performed by:
employing the phase difference image to locate an implant in the subject; and
displaying the location of the implant in the magnitude image.

6. (Original) The method as recited in claim 1 in which the subject is tissues containing an implant.

7. (Original) The method as recited in claim 6 in which the tissues include a human prostate and the implant is a brachytherapy seed.

Inventor Kiaran McGee, et al.
Serial No.: 10/016,527
AMENDMENT
Page 4

Client Docket MMV-01-042

8. (Currently Amended) A method for producing an image of tissues containing an implant with a magnetic resonance imaging (MRI) system, the steps comprising:

- a) acquiring first and second k-space data sets with the MRI system by performing a series of pulse sequences which acquire a set of NMR spin-echo signals for the first k-space data set and a set of NMR gradient-recalled echo signals for the second k-space data set;
- b) reconstructing first and second complex MR images of the tissues containing the implant from the respective first and second k-space data sets;
- c) calculating a phase difference MR image ~~from~~ between the first and second complex MR images;
- d) calculating a magnitude MR image using data from either said first or second complex MR images; and
- e) employing the phase difference MR image of step c) to display the location of the implant in the magnitude MR image of step d) ~~to~~ and form the image.

9. (Original) The method as recited in claim 8 in which step b) is performed by performing a complex Fourier transformation of each of the first and second k-space data sets.

10. (Original) The method as recited in claim 8 in which step a) is performed by:

- i) performing a first pulse sequence to acquire the NMR spin-echo signals; and
- ii) performing a different pulse sequence to acquire the NMR gradient-recalled signals.

11. (Original) The method as recited in claim 10 in which one NMR signal is acquired with each pulse sequence.

Inventor Kiaran McGee, et al.
Serial No.: 10/016,527
AMENDMENT
Page 5

Client Docket MMV-01-042

12. (Original) The method as recited in claim 8 in which step c) is performed by:

- i) calculating a first phase image from the first complex image;
- ii) calculating a second phase image from the second complex image;
- iii) calculating the phase difference image by computing the phase difference between corresponding pixels in the first and second phase images.

13. (Original) The method as recited in claim 8 in which the tissues include a human prostate and the implant is a brachytherapy seed.

14. (Original) The method as recited in claim 8 in which the implant is formed of titanium.

15. (Cancelled) A method for producing an image of tissues containing an implant with a magnetic resonance imaging (MRI) system; the steps comprising:

- a) acquiring a complex k-space data set with the MRI system using a pulse sequence;
- b) reconstructing a complex MR image by Fourier transforming the complex k-space data set;
- c) calculating a phase MR image from the complex MR image which differentiates between the implant and surrounding tissues;
- d) calculating a magnitude MR image from the complex MR image which differentiates between tissues;
- e) locating the implant in the tissues using information in the phase MR image; and
- f) displaying the location of the implant in the magnitude MR image.

16. (Currently Amended) The method as recited in claim ~~45~~ 8 in which step ~~f)~~ e) is performed by modifying pixels in the magnitude image at the implant location.

Inventor Kiaran McGee, et al.
Serial No.: 10/016,527
AMENDMENT
Page 6

Client Docket MMV-01-042

17. (Currently Amended) The method as recited in claim 45 8 in which step f) e) is performed by overlaying a graphical representation of the implant at the implant location.

18. (Cancelled) The method as recited in claim 15 in which the tissues include a human prostate and the implant is a brachytherapy seed.

19. (Currently Amended) A method for producing an image of a subject with a magnetic resonance imaging (MRI) system which differentiates between soft tissues and which differentiates between tissues and a device, the steps comprising

- a) acquiring a first k-space data set with the MRI system using a spin-echo pulse sequence;
- b) acquiring a second k-space data set with the MRI system using a gradient-recalled echo pulse sequence;
- c) reconstructing first and second complex MR images of the subject from the respective first and second k-space data sets;
- d) calculating a phase difference MR image from between the first and second complex images which differentiates between tissues and the device;
- e) calculating a magnitude MR image from either one of said first or second complex MR images which differentiates between tissues; and
- f) combining the phase difference MR image of step d) with the magnitude MR image of step e) to form the image of the subject.